

REMARKS

This Amendment is filed in response to the Office Action dated May 21, 2004, which has a shortened statutory period set to expire August 21, 2004.

SPECIFICATION

The specification is objected to as failing to provide proper antecedent basis for the limitation "a non-functional region of the test sample" in Claims 19 and 35. However, paragraph 21 of the specification as originally filed recites in part:

This risk of damage can be further reduced by **performing the cleaning operation on non-functional regions of test sample 210** (e.g., regions such as scribe lines that will not be part of the functional portion(s) of the final devices to be made from test sample 210). (Emphasis added.)

Accordingly, Applicants submit that proper antecedent basis for the cited limitation in Claims 19 and 35 is provided in the specification as originally filed. Withdrawal of the objection to the specification is therefore respectfully requested.

DRAWINGS

The drawings are objected to under 37 C.F.R. 1.83(a) for not showing the "optical fiber for transmitting the laser beam from an energy beam generator to the portion of the contaminant layer" of Claim 17. A replacement sheet for Figs. 2a and 2b is submitted with this paper adding optional optical fiber 232 to Fig. 2a. Support for this drawing amendment is found in the specification as originally filed at least at paragraph 23.

Note that paragraph 23 is amended to properly cite optional optical fiber 232. No new matter is added.

Accordingly, Applicants respectfully request withdrawal of the objection to the drawings.

CLAIMS

Claims 1-21, 24, 27-37, 41-44, 47, and 50 are pending in the present application. The Examiner has objected to Claim 42 for lacking antecedent basis for the phrase "the thin film analysis module". Claim 42 is amended to recite instead "the means for measuring the thin film", thereby correcting a an obvious and inadvertent clerical error in the original claim. No new matter is added. Proper antecedent basis for amended Claim 42 is provided by Claim 41, from which Claim 42 depends.

In light of the above-described amendment, withdrawal of the objection to Claim 42 is respectfully requested.

Rejections Under 35 U.S.C. 102 - Elliott

Claims 1, 8, 14, 17, 18, 20, 21, 24, 27, 28, 33, 36, 37, 41, 44, 47, and 50 stand rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 5,669,979, issued September 23, 1997 to Elliott et al. (hereinafter "Elliott"). Claims 28 and 50 are cancelled, rendering the rejection of those claims moot. Applicants respectfully traverse the rejection of Claims 1, 8, 14, 17, 18, 20, 21, 24, 27, 33, 36, 37, 41, 44, and 47.

Claim 1, as amended, recites:

A thin film analysis system ... comprising: an energy beam source for directing an energy beam at the contaminant layer during a cleaning operation ... and a **thin film analysis module for measuring the thin film** at the analysis area. (Emphasis added.)

Support for this amendment is found in the specification as originally filed at least at paragraphs 18, 19, 24, and 25 and

in Fig. 2b. No new matter is added. A thin film analysis system that includes an energy beam source for cleaning and a thin film analysis module beneficially allows:

[a] measurement operation [to] be performed immediately following the cleaning operation, so that the chances of recontamination of the exposed portion (analysis area) of thin film layer 212 are minimized. (Specification as originally filed at paragraph 24.)

Meanwhile, Elliott simply teaches "[a] method of cleaning a substrate surface." (Elliott, abstract.) The Examiner states that "[t]he probe beam of the monitoring laser is approximately at the same position as the cleaning laser (Fig. 15: 518, 420, 428, 416)", thereby seeming to indicate that monitor 520 in Fig. 15 of Elliott represents "a thin film analysis module" as recited by Claim 1. However, Elliott explicitly states that "[m]onitor 520 could be configured to receive a reflected diagnostic beam 522 to verify that a surface has been cleaned" (Elliott, col. 21, lines 31-33). Monitor 520 of Elliott therefore is directed towards contaminant layer detection, and is not "a thin film analysis module for measuring the thin film at the analysis location" as recited in Claim 1. Elliott is purely directed towards cleaning, and does not mention or suggest "measuring the thin film" as recited in Claim 1.

For at least this reason, Claim 1 is allowable over Elliott. Claims 8, 14, 17, 18, 20, 21, and 24 depend from Claim 1, and are therefore allowable over Elliott for at least the same reasons that Claim 1 is allowable. Applicants therefore respectfully request reconsideration and withdrawal of the rejections of Claims 1, 8, 14, 17, 18, 20, 21, and 24.

Claim 27, as amended, recites "[a] method comprising: directing an energy beam ... to expose a first analysis area of the thin film; and **measuring the thin film** at the first analysis area." (Emphasis added.) Support for this amendment is found

in the specification as originally filed at least at paragraphs 18, 19, 24, and 25 and in Fig. 2b. No new matter is added.

For reasons similar to those described above with respect to Claim 1, Claim 27 is allowable over Elliott, as Elliott does not teach or suggest "measuring the thin film at the first analysis area" as recited by Claim 27. Claims 33, 36, and 37 depend from Claim 27, and are therefore allowable over Elliott for at least the same reasons that Claim 27 is allowable. Applicants therefore respectfully request reconsideration and withdrawal of the rejections of Claims 27, 33, 36, and 37.

Claim 41, as amended, recites a "thin film analysis system comprising means for directing an energy beam at the contaminant layer during a cleaning operation ... and **means for measuring the thin film** at the analysis area." (Emphasis added.) Support for this amendment is found in the specification as originally filed at least at paragraphs 18, 19, 24, and 25 and in Fig. 2b. No new matter is added.

For reasons similar to those described above with respect to Claim 1, Claim 41 is allowable over Elliott, as Elliott does not teach or suggest "means for measuring the thin film at the analysis location" as recited in Claim 41. Claims 44 and 47 depend from Claim 41, and are therefore allowable over Elliott for at least the same reasons that Claim 41 is allowable. Applicants therefore respectfully request reconsideration and withdrawal of the rejections of Claims 41, 44, and 47.

Rejections Under 35 U.S.C. 102 - Abercrombie

Claims 1, 7, 8, 24, 27, 28, 32, 33, 41, 42, and 47 stand rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 5,666,063, issued September 9, 1997 to Abercrombie et al. (hereinafter "Abercrombie"). Claim 28 is cancelled, rendering the rejection of that claim moot. Applicants

respectfully traverse the rejection of Claims 1, 7, 8, 24, 27, 32, 33, 41, 42, and 47.

Claim 1, as amended, recites:

A thin film analysis system ... comprising:
an energy beam source for directing an energy beam at the contaminant layer during a cleaning operation, the energy beam being configured to remove a portion of the contaminant layer to **expose an analysis area on the thin film**; and
a thin film analysis module for **measuring the thin film at the analysis area**. (Emphasis added.)

Abercrombie teaches "an apparatus 10 which can be used to probe a plurality of integrated circuits ... while insuring that the probe needles of a probe card are adequately clean."

(Abercrombie, col. 4, lines 4-7.) Abercrombie therefore relates to electrical probing, in which "integrated circuits [are] electrically probed to determine that the **integrated circuits are functioning properly**." (Abercrombie, col. 1, lines 12-14.) (Emphasis added.)

Abercrombie does not teach or suggest "measuring the **thin film** at the analysis area" (emphasis added) as recited in Claim 1. Electrical probing is fundamentally different from "measuring the thin film" as recited in Claim 1, in that electrical probing investigates circuit functionality, while thin film measurement investigates thin film characteristics (e.g., "the thickness and composition of each thin film" (specification, paragraph 2)). The two realms therefore have substantially different goals, use substantially different techniques, and have substantially different concerns. Abercrombie makes no explicit reference to thin film measurement, nor does Abercrombie suggest any applicability to thin film measurement.

Indeed, Abercrombie specifically mentions that "[t]he laser ablation technique can be used to clean conductive C4 bumps or

conductive external terminals," (Abercrombie, col. 5, lines 29-30) two types of non-thin film structures that are directly related to electrical probing. Abercrombie never mentions nor implies, even in passing, that the "clean[ing of] conductive C4 bumps or conductive external terminals" (Abercrombie, col. 5, line 30) for improved electrical probing can be used in the fundamentally different realm of thin film measurement.

For at least this reason, Claim 1 is allowable over Abercrombie. Claims 7, 8, and 24 depend from Claim 1, and are therefore allowable over Abercrombie for at least the same reasons that Claim 1 is allowable. Applicants therefore respectfully request reconsideration and withdrawal of the rejections of Claims 1, 7, 8, and 24.

Claim 27, as amended, recites "[a] method comprising: directing an energy beam ... to expose a first analysis area of the thin film; and **measuring the thin film** at the first analysis area." (Emphasis added.) Support for this amendment is found in the specification as originally filed at least at paragraphs 18, 19, 24, and 25 and in Fig. 2b. No new matter is added.

For reasons similar to those described above with respect to Claim 1, Claim 27 is allowable over Abercrombie, as Abercrombie does not teach or suggest "measuring the thin film at the first analysis area" as recited by Claim 27. Claims 32 and 33 depend from Claim 27, and are therefore allowable over Abercrombie for at least the same reasons that Claim 27 is allowable. Applicants therefore respectfully request reconsideration and withdrawal of the rejections of Claims 27, 32, and 33.

Claim 41, as amended, recites a "thin film analysis system comprising means for directing an energy beam at the contaminant layer during a cleaning operation ... and **means for measuring the thin film** at the analysis area." (Emphasis added.) Support

for this amendment is found in the specification as originally filed at least at paragraphs 18, 19, 24, and 25 and in Fig. 2b. No new matter is added.

For reasons similar to those described above with respect to Claim 1, Claim 41 is allowable over Abercrombie, as Abercrombie does not teach or suggest "means for measuring the thin film at the analysis location" as recited in Claim 41. Claims 42 and 47 depend from Claim 41, and are therefore allowable over Abercrombie for at least the same reasons that Claim 41 is allowable. Applicants therefore respectfully request reconsideration and withdrawal of the rejections of Claims 41, 42, and 47.

Rejections Under 35 U.S.C. 103 - Elliott and Lensing

Claims 2-5, 29, and 30 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Elliott in view of U.S. Patent No. 6,383,824, issued May 7, 2002 to Lensing (hereinafter "Lensing"). Applicants respectfully traverse this rejection.

Claim 1 recites a "thin film analysis system comprising [] **an energy beam source ... and a thin film analysis module.**" (Emphasis added.) This integration made possible by the localized cleaning beneficially "eliminat[es] any delays related to transferring the wafer to and from a stand-alone cleaning system ... [and] minimizes the total footprint required for a thin film analysis system" (Specification as originally filed, paragraph 9.)

As noted above, Elliott describes "[a] method for cleaning a substrate surface" (Elliott, abstract) and does not teach or suggest integration with **"a thin film analysis module for measuring the thin film at the analysis area"** (emphasis added) as recited in Claim 1. Lensing is directed towards **"a method of using scatterometry measurements to control deposition**

processes, and a system for accomplishing same" (emphasis added) (Lensing, col. 2, lines 59-61), and does not teach or suggest integration with "an **energy beam source for directing an energy beam at the contaminant layer during a cleaning operation**" (emphasis added) as recited in Claim 1. Therefore, no explicit impetus to combine Elliott with Lensing is present.

Furthermore, the nature of the cleaning operation described by Elliott actually teaches away from combination with the scatterometry/deposition system of Lensing. Elliott is directed towards cleaning an entire wafer - e.g., ensuing that "after a substrate has passed through the beams in the scan direction 232 **the entire surface of the substrate would have been exposed to the laser energy.**" (Emphasis added.) (Elliott, col. 14, lines 54-56.) To perform this bulk cleaning, Elliott teaches:

[a] **combination of providing a directed flow of a fluid**, including a reactant, in the vicinity of the foreign material, **and delivering a beam of radiation** to aid the reactant to react with the foreign material to form the reaction product(s). (Emphasis added.) (Elliott, col. 1, lines 46-50.)

Consequently, the cleaning system of Elliott makes use of a large number of system components (fluid control components) to both provide the directed flow of the fluid and also "caus[e] the cloud of ablation components to flow away from the previously cleaned regions of the wafer." (Elliott, col. 10, lines 61-64.) As shown in Figs. 15 and 16 of Elliott, such a system includes dedicated gas cylinders 486, mass flow regulators 452, a mixing chamber 524, a gas valve 482, an evacuation valve 446, a charcoal filter 445, and a mechanical pump 444. All these additional components can make integration with the scatterometry/deposition system of Lensing cumbersome if not completely infeasible.

For at least this reason, Claims 2-5, which depend from Claim 1, are allowable over Elliott in view of Lensing. Applicant therefore respectfully requests reconsideration and withdrawal of the rejections of Claims 2-5.

Claim 27, as amended, recites:

directing an energy beam at a first location on the contaminant layer while the test sample is on the stage, the energy beam removing a first portion of the contaminant layer to expose a first analysis area of the thin film; and measuring the thin film at the first analysis area while the test sample is on the stage. (Emphasis added.)

Support for this amendment is found in the specification as originally filed at least at paragraphs 9-13, 24-25, and 32-34, and in Figs. 2a, 2b, 3a, and 3b. No new matter is added.

As described above with respect to Claim 1, there is no motivation to combine the cleaning system of Elliott with the deposition/scatterometry system of Lensing due to the large fluid control components required for the cleaning system of Elliott. Therefore, the cleaning of Elliott and the deposition/scatterometry of Lensing would be performed in different chambers, and would therefore not involve "cleaning ... [and] measuring ... on the [same] stage" as recited in Claim 27.

For at least this reason, Claims 29 and 30, which depend from Claim 27, are allowable over Elliott in view of Lensing. Applicant therefore respectfully requests reconsideration and withdrawal of the rejections of Claims 29 and 30.

Rejections Under 35 U.S.C. 103 - Elliott and Morris

Claims 9-13, 15, 34, and 43 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Elliott in view of U.S. Patent No. 6,472,295, issued October 29, 2002 to Morris et al.

(hereinafter "Morris"). Applicants respectfully traverse this rejection.

As noted above, Elliott describes "[a] method for cleaning a substrate surface" (Elliott, abstract) and does not teach or suggest a thin film analysis system that includes both "an **energy beam source** for directing an energy beam at the contaminant layer **during a cleaning operation** ... and a **thin film analysis module for measuring the thin film** at the analysis area" as recited in Claim 1. Morris is directed towards "a method and apparatus for employing laser light to generate high precision through-cuts in a target material" (Morris, col. 1, lines 6-8), and does not mention any "cleaning operation" or "thin film analysis module" as recited in Claim 1. Therefore, Morris does not remedy the deficiencies of Elliott.

For at least this reason, Claims 9-13 and 15, which depend from Claim 1, are allowable over Elliott in view of Morris. Applicant therefore respectfully requests reconsideration and withdrawal of the rejections of Claims 9-13 and 15.

As noted above, Elliott does not teach or suggest a method that includes both "**directing an energy beam** at a first location ... to **expose a first analysis area** of the thin film [] and **measuring the thin film** at the first analysis area" as recited in Claim 27. Morris is directed towards "a method and apparatus for employing laser light to generate high precision through-cuts in a target material" (Morris, col. 1, lines 6-8), and does not mention "expos[ing] a first analysis area" or "measuring the thin film" as recited in Claim 27. Therefore, Morris does not remedy the deficiencies of Elliott.

For at least this reason, Claim 34, which depends from Claim 27, is allowable over Elliott in view of Morris. Applicant therefore respectfully requests reconsideration and withdrawal of the rejection of Claim 34.

As noted above, Elliott does not teach or suggest a thin film analysis system that includes both "means for **directing an energy beam** at the contaminant layer **during a cleaning operation** ... and **means for measuring the thin film** at the analysis area" as recited in Claim 41. Morris is directed towards "a method and apparatus for employing laser light to generate high precision through-cuts in a target material" (Morris, col. 1, lines 6-8), and does not mention any "cleaning operation" or "measuring the thin film" as recited in Claim 41. Therefore, Morris does not remedy the deficiencies of Elliott.

For at least this reason, Claim 43, which depends from Claim 41, is allowable over Elliott in view of Morris. Applicant therefore respectfully requests reconsideration and withdrawal of the rejection of Claim 43.

Rejections Under 35 U.S.C. 103 - Elliott and Fukuda

Claims 6 and 31 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Elliott in view of U.S. Patent No. 4,876,983, issued October 31, 1989 to Fukuda et al. (hereinafter "Fukuda"). Applicants respectfully traverse this rejection.

As noted above, Elliott describes "[a] method for cleaning a substrate surface" (Elliott, abstract). Fukuda is directed towards "a plasma operation apparatus suitable for performing thin film deposition" (Fukuda, col. 1, lines 6-7), but does mention the measurement of "the Si/O atomic ratio in the deposited film ... through Auger electron spectroscopy" (Fukuda, col. 11, lines 46-47). However, as noted above, the bulk cleaning operation of Elliott teaches away from any integration of the cleaning system of Elliott with another processing tool (such as the plasma operation apparatus of Fukuda). Therefore, Elliott in view of Fukuda does not teach or suggest a thin film analysis system that includes both "an **energy beam source** for

directing an energy beam at the contaminant layer **during a cleaning operation ... and a thin film analysis module for measuring the thin film at the analysis area**" (emphasis added) as recited in Claim 1.

For at least this reason, Claim 6, which depends from Claim 1, is allowable over Elliott in view of Fukuda. Applicant therefore respectfully requests reconsideration and withdrawal of the rejection of Claim 6.

For similar reasons, Elliott in view of Fukuda does not teach or suggest **"directing an energy beam at a first location on the contaminant layer while the test sample is on the stage ... and measuring the thin film at the first analysis area while the test sample is on the stage"** (emphasis added) as recited by Claim 27. (Emphasis added.)

For at least this reason, Claim 31, which depends from Claim 27, is allowable over Elliott in view of Fukuda. Applicant therefore respectfully requests reconsideration and withdrawal of the rejection of Claim 31.

Rejections Under 35 U.S.C. 103 - Elliott and Haight

Claim 16 stands rejected under 35 U.S.C. 103(a) as being unpatentable over Elliott in view of U.S. Patent No. 6,333,485, issued December 25, 2001 to Haight et al. (hereinafter "Haight"). Applicants respectfully traverse this rejection.

As noted above, Elliott describes "[a] method for cleaning a substrate surface" (Elliott, abstract) and does not teach or suggest a thin film analysis system that includes both "an **energy beam source** for directing an energy beam at the contaminant layer **during a cleaning operation ... and a thin film analysis module for measuring the thin film at the analysis area**" as recited in Claim 1. Haight is directed towards "a method to localize laser induced breakdown" (Haight, col. 1,

lines 36-37), and does not mention "a thin film analysis module" as recited in Claim 1. Therefore, Haight does not remedy the deficiencies of Elliott.

For at least this reason, Claim 16, which depends from Claim 1, is allowable over Elliott in view of Haight. Applicant therefore respectfully requests reconsideration and withdrawal of the rejection of Claim 16.

Rejections Under 35 U.S.C. 103 - Elliott

Claims 19 and 35 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Elliott. Applicants respectfully traverse this rejection.

As noted above, Elliott does not teach or suggest a thin film analysis system that includes both "an **energy beam source** for directing an energy beam at the contaminant layer **during a cleaning operation ...** and a **thin film analysis module for measuring the thin film** at the analysis area" as recited in Claim 1. Nor does Elliott teach or suggest a method that includes both "**directing an energy beam** at a first location ... to **expose a first analysis area** of the thin film [] and **measuring the thin film** at the first analysis area" as recited in Claim 27. Therefore, even assuming, arguendo, that it would be obvious that the analysis area comprises a non-functional area, as the Examiner seems to imply, the deficiencies of Elliott are not remedied.

For at least this reason, Claim 19, which depends from Claim 1, and Claim 35, which depends from Claim 27, are allowable over Elliott. Applicant therefore respectfully requests reconsideration and withdrawal of the rejections of Claims 19 and 35.

CONCLUSION

Claims 1-21, 24, 27, 29-37, 41-44, and 47 are pending in the present Application. Reconsideration and allowance of these claims is respectfully requested.

If there are any questions, please telephone the undersigned at (408) 451-5903 to expedite prosecution of this case.

Respectfully submitted,



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I hereby certify that this correspondence is being deposited with the United States Postal Service as FIRST CLASS MAIL in an envelope addressed to: Mail Stop Amendment, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on August 23, 2004.

8/23/2004
Date

Rebecca A. Baumann
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